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Hancockia schoeferti, spec. nov., a new dendronotoidean nudibranch species from central Chile

(Gastropoda, Nudibranchia, Hancockiidae)

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Dendronotoid specimens reported from central Chile as "*Hancockia* sp. 1" by Schrödl (1996) are herein described anatomically and compared with other members of the genus *Hancockia* Gosse, 1877. The species studied comes closest to the rare northeastern Pacific species *H. californica* MacFarland, 1923, which has been re-examined here. It significantly differs from *H. californica* due to a distal allosperm receptacle rising from the vagina with a distinct stalk, while in *H. californica* the vagina is swollen to a wide sac which may also serve as a sperm receptacle. The Chilean species is therefore considered to be new; it is established under the name *Hancockia schoeferti* spec. nov. In contrast to other congeners, *Hancockia schoeferti* spec. nov. is locally abundant, living on kelp fronds and other macroalgae covered with hydrozoa on which it feeds.

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Introduction

With only five species known the Hancockiidae are a small nudibranch family (see Thompson 1972). Possessing ramified cerata on the notal edge, a bilobed velum bearing finger-like processes, and rhinophoral sheaths, the single genus *Hancockia* Gosse, 1877 externally resembles typical dendronotoideans. However, the strongly contractile cerata are aberrant in shape, somewhat resembling human hands facing lateral. Anterior pairs of cerata are opposite while posterior ones alternate, with right cerata successively more posterior. In contrast to all other dendronotoideans, *Hancockia* possesses cnidosacs which Thompson (1972) described to contain functional nematocysts. Also the presence of an unpaired median buccal gland is unusual. While distributed worldwide throughout warmer oceans (see Thompson 1972), *Hancockia* was rarely found and never collected in large numbers. In central Chile, however, an undescribed *Hancockia* species was mentioned to be common (Schrödl 1996). A large number of specimens observed *in situ* and examined in their morphological and anatomical variation leads to a detailed description of this new Chilean species.

Methods

Most specimens of *Hancockia schoeferti*, spec. nov. have been collected using SCUBA. After observing the specimens *in situ* and in aquaria they were narcotized with a 10 % $MgCl_2$ solution and preserved in 70 % ethanol

or 4 % formalin/seawater. Six specimens were dissected. SEM examinations of radulae were made using a Philips XL 20 Scanning Electron Microscope. For comparision, material of similar species has also been studied: *Hancockia californica* MacFarland, 1923, 14 specimens (Zoological Museum Copenhagen; ZMUC), collected by H. Lemche, May 1954, Hopkins Marine Station, Monterey Bay, California, lower littoral, two dissected; *Hancockia uncinata* (Hesse, 1872): One specimen, collected by I. Friedrich, 03 June 1998, Fetovaia, Elba Island, Italy, on sea grass.

Hancockia schoeferti, spec. nov.

Figs 1,3,4,5

Types. Holotype: Zoologische Staatssammlung München (ZSM), No. 19983471, collected by M. Schrödl, 31 January 1994; Bay of Coliumo (36°32'S, 72°57'W), at 0-3 m depth, on fronds of *Macrocystis pyrifera* (L.) covered with hydrozoans. – Paratypes: ZSM No 19983472, 10, collected together with the holotype. ZSM No 19983473; 1, collected together with the holotype, dissected. Museo Zoológico de la Universidad de Concepción, Chile; 1, collected together with the holotype.

Additional material: 45 ex., collected by M. Schrödl, April to May 1991; Bay of Coliumo, at 0-5 m depth, on various macroalgae (*Macrocystis, Gracilaria, Iridaea, Ulva*) covered with hydrozoans; 32 ex., collected by M. Schrödl, January 1994; Bay of Coliumo, at 0-8 m depth, on various macroalgae covered with hydrozoans; 3 ex., collected by M. Schrödl, March 1994; Bay of Coliumo, at 0-2 m depth, on macroalgae; 16 ex., collected by M. Schrödl, December 1994; Bay of Coliumo, at 0-1 m depth, on giant kelp fronds covered with hydrozoans; 1 ex., collected by M. Schrödl, 29 January 1995; Queule (39°23'S, 73°13'W), at 8 m depth, on macroalgae.

Description

External morphology (Fig. 4). Actively crawling specimens measured up to 25 mm in length. Preserved specimens studied range between 1 and 10 mm in length. The body shape is elongate. Cerata occur in 4-5, rarely 6 pairs on the distinct notal rim, the first pair opposite and anterior to the prominent pericardium. In the postcardiac pairs the cerata on the right side are successively located more posterior than the left ones. Often there are four pairs of cerata and one additional, very small ceras on the left. The number of cerata is not directly correlated with the body size, e.g. living specimens from the same population with 2.5 and 20 mm both have 5 pairs of cerata. The two anterior pairs of cerata are large sized, more posterior ones decrease in size. Having a short stalk, the cerata are palmate distally, the largest cerata with 9-15 digitiform, candelabrum-like ramified processes. A specimen with 2.5 mm body length has up to 9, a 20 mm specimen up to 12 processes. Ramifications of the digestive gland extending into the cerata processes are visible through the tissue. The digestive ducts terminate within small, bulbous structures referred to as cnidosacs by most authors. The position of cnidosacs is externally marked by knob-like elevations. Zig-zaging notal ridges connecting the postcardiac cerata correspond to major vessels leading haemolymph from the cerata to the heart. The rhinophores are enclosed by a sheath having a lobulate edge with 5-12 warts. From posterodorsally, a single digestive gland duct extends into each rhinophoral sheath. Ramifying subapically, each branch terminates in cnidosacs which are visible as knob-like elevations on the edge of the rhinophoral sheaths. The clavi of the rhinophores are bulbous basally bearing about 10 vertical lamellae. They terminate within a short stalk with a small apical bulb. Eyes are visible behind the bases of the rhinophores. Two semilunar projections surround the mouth laterally. The oral veil is bilobed, each lobe is divided into 3-10 finger-like projections. The foot is slightly broader than the body wall. The anterior foot edge has a median notch. The tail is blunt and usually curled up in life. The anus is located on the right between the first and second cerata, the genital opening lateral between the rhinophore and the first ceras.

Colour (Fig. 4). Small specimens often are whitish translucent; ducts of the digestive glands may shine through the tissue. With increasing growth specimens become more and more dotted with red, brown and opaque white pigments. Depending on the quantity and relation of the different pigments, specimens appear red, reddish, greenish or olive, and are more or less spotted with white dots. Cerata, notal rims and rhinophore sheaths usually are stronger pigmented than foot, body walls and median parts of the notum. The stalks and apical bulbs of the rhinophore clavi are always white. Cnidosacs are usually marked with white pigment. The body colouration of larger individuals almost always corresponds to the main type of algal substrate, i.e. greenish colours for specimens from kelp but reddish for those from red algae.

Fig. 1. *Hancockia schoeferti,* spec. nov. SEM photograph of rhachidian and lateral radular teeth. Scale bar: 20 μm.

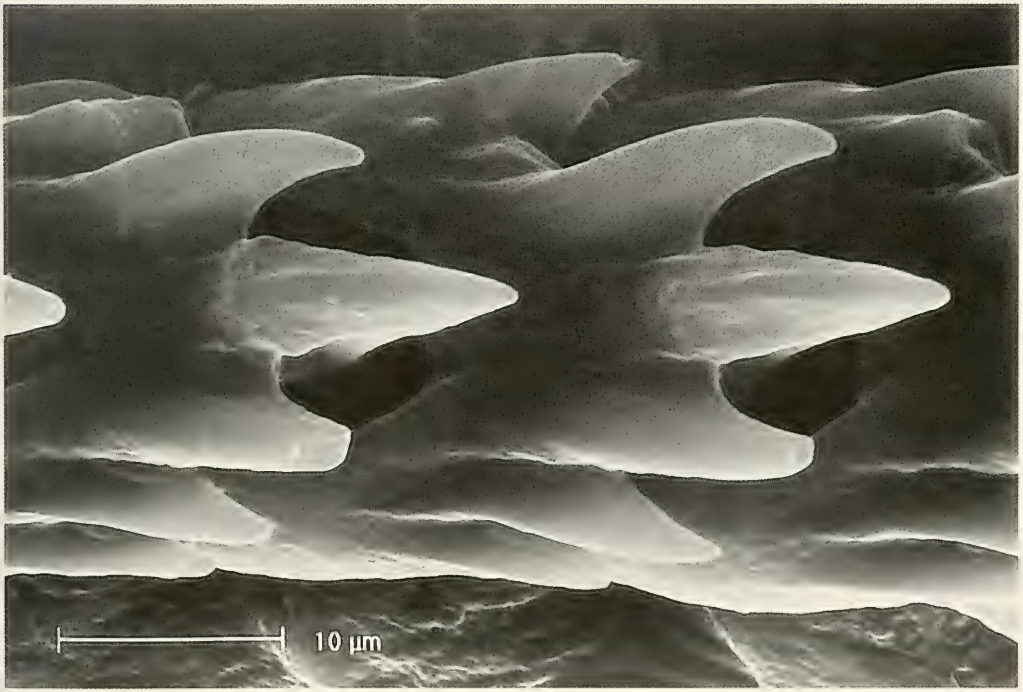

Fig. 2. *Hancockia californica* MacFarland. SEM photograph of rhachidian radular teeth. Scale bar: 10 μm.

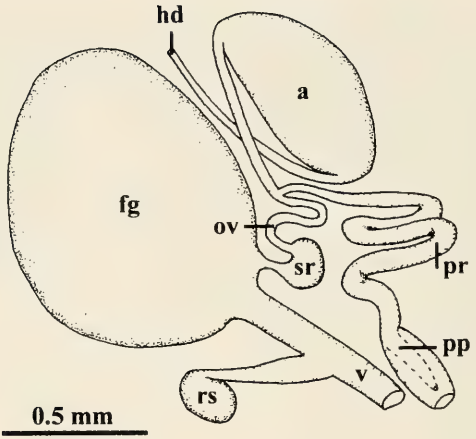

Fig. 3. *Hancockia schoeferti*, spec. nov. Outline of the genital system. Scale bar: 0.5 mm. Abbreviations: a: ampulla; fg: female glands; hd: hermaphroditic duct; ov: oviduct; pp: penial papilla; pr: prostatic vas deferens; rs: distal allosperm receptacle; sr: proximal seminal receptacle; v: vagina.

Digestive system (Figs 1 A,B). Around the mouth there are simple labial glands. The oral tube has a round, chitinized lip disk with rodlets. Ventrally, two long, highly ramified oral glands extend dorso-laterally into the shafts of the rhinophores. An additional median, unpaired oral gland extends posterior as a long, unbranched tube. The wide triangular, yellowish jaws are delicate. The masticatory border is denticulate. The radula formula is 46-55 × 1.1.1; in a specimen with a preserved body length of 6 mm it is 52 × 1.1.1. The central teeth have a large, slightly depressed median cusp with four to five smaller denticles per side. The base is highly arched, the height is similar to the width. The lateral teeth are thin rectangular plates with an elongate pointed cusp on the inner side. The base is more than twice as wide as the height at the cusp. Salivary glands are small and located on the esophagus as a rather diffuse mass. The esophagus is a slightly convoluted tube. Close to the stomach, a wide, sac-like gastric diverticulum arises dorsally. The anterior stomach is thin-walled. The left and right anterior digestive gland ducts branch off dorsally. The larger, posterior digestive gland duct opens ventro-posteriorly. The large, thick-walled posterior (grinding) stomach bears cuticular ridges. It covers the anterior stomach portion dorsally. The intestine forms a short loop towards the anus.

Reproductive system (Fig. 3). The genital system is androdiaulic. The gonad fills the posterior half of the body cavity. It consists of a high number of densely packed ancini joining into a hermaphroditic duct. The hermaphroditic ampulla is ovate. The rather long postampullar gonoduct leaves the elongate ampulla opposite the insertion. The vas deferens inmediately widens into a thick and convoluted prostatic portion. The muscular penial papilla is flagelliform. The vagina opens closely posterior to the male opening. Some distance inside, the tubular, wide vagina bears a narrowing duct which leads to a bulbous, rounded allosperm receptacle. Close to the insertion of the vagina, a short, narrow duct leaves the female gland mass. It enters a small, flattened, serially arranged sac which may be a proximal sperm receptacle. The oviduct is narrow and coiled.

Other organs. The cerebropleural ganglia are completely fused. There is a separate rhinophoral ganglion at the base of the clavus. The optical nerves are short. The buccal ganglia are close together. The kidney is a long sac with transversal diverticula covering the viscera dorsally.

Natural history (Fig. 4). All specimens were found in the upper subtidal between 0 and 8 m depth. Most were found to be perfectly camouflaged on macroalgae covered with hydrozoans. Some were offshore in masses of drifting kelp as also mentioned for *H. californica* by McDonald (1983). In the aquarium, specimens were observed to graze on the layer of hydrozoans covering a variety of different macroalgae from their collecting localities. Feeding appears not to be very selective since beside hydrozoans also small epiphytic algae such as diatomeans were ingested. Occasional pigment uptake from the algal substrate may cause the body coloration similar to their natural substrate observed in most larger specimens. In aquaria, no substrate preference related to brown or red algae could be

Fig. 4. *Hancockia schoeferti,* spec. nov. Drawing of a living specimen (15 mm length) with spawn in natural surrounding.

Fig. 5. *Hancockia schoeferti*, spec. nov. Geographic distribution.

observed for the differently coloured specimens. Several specimens were observed floating upside down on the water surface as described for *H. californica* and *H. ryrca* in their natural habitat (MacFarland 1966, Marcus 1957).

Small to large sized specimens and spawn were found from December to early May in the Bay of Coliumo. The spawn is a coiled ribbon (see Fig. 4), up to about 1 cm long and fixed to the substrate along one edge. Egg capsules are ovate, measuring up to 200 μm in length. There are 4 to about 10 small (< 100 μm in diameter) white eggs per capsule. Free swimming larvae hatched after 18 days in the aquarium (at 15-16 °C).

Geographic distribution (Fig. 5). *Hancockia schoeferti*, spec. nov. ranges from the central Chilean Bay of Coliumo (36°32'S, 72°57'W) south to Queule (39°23'S, 73°13'W) near Valdivia.

Etymology. *Hancockia schoeferti*, spec. nov. is dedicated to Mr. Lothar Schöfert for his generous financial support of the biosystematic research at the ZSM.

Discussion

Only five *Hancockia* species from the world's oceans were recognized as being valid by Thompson (1972). *Hancockia burni* Thompson, 1972, from tropical Australia has rhinophoral sheaths with digitate processes, while other known species including *H. schoeferti*, spec. nov. differ in having sheaths with more or less blunt or lobate processes. *Hancockia uncinata* (Hesse, 1872) reported from the Mediterranean Sea and northeastern Atlantic Ocean has broad, lobe-like, highly contractile cerata rising from the notal rim without forming a distinct stalk (see Schmekel & Portmann 1982, Cattaneo-Vietti et al. 1991, this study). *Hancockia uncinata* from the Spanish Atlantic coast was, however, figured as having cerata with distinct stalks by Ortea & Urgorri (1979). *Hancockia schoeferti*, spec. nov., the northeastern Pacific *H. californica* (MacFarland 1923, Behrens 1991, this study), and possibly also all other known congeners have cerata with a short but distinct stalk (see O'Donoghue 1932, Marcus 1957, Thompson 1972). A large specimen (15 mm length) of *Hancockia ryrca* Marcus, 1957 from Brazil was described as having only few digitiform processes per ceras (2-8). Even small *H. schoeferti*, spec. nov. have more than 8 processes and this seems also to be true for other congeners like *H. papillata* (O'Donoghue, 1932) which is only known from a single small specimen (4 mm length) from southern India (see Thompson 1972). The latter species is distinguished from *H. schoeferti* and other congeners by a row of mediodorsal papillae. *Hancockia californica* externally comes close to *H. schoeferti*. It may differ in often having 6 left and 5 right cerata (2-8 mm preserved body length; this study) while *H. schoeferti* spec. nov. usually has only 5 left and 4 right cerata. The digestive gland ducts ramify already at the bases of the rhinophores in *H. californica* (MacFarland 1923, this study) but closely below the lobulate edges of the rhinophoral sheaths in *H. schoeferti*.

Internally, *H. californica* and *H. schoeferti* largely agree regarding radular characters and the common possession of a gastric diverticulum (see Thompson 1972, this study). According to MacFarland (1923, 1966), the central cusp of rhachidian radular teeth is larger in relation to lateral denticles in *H. californica* than in *H. schoeferti*. One *H. californica* specimen studied by SEM herein has central cusps similarly shaped but more prominent than those of *H. schoeferti* (see Figs 1, 2). Another slight difference may or may not be related to the lateral teeth of *H. californica* having a pair of small basal denticles (MacFarland 1923) which have neither been detected in a specimen of *H. californica* dissected during the present study nor in *H. schoeferti*. The reproductive systems, however, are significantly different: *Hancockia californica* has an extremely large, bulbous penial papilla (MacFarland 1923, 1966, this study). In *H. schoeferti* the penial papilla is more slender having a flagelliform shape. The distal allosperm receptacle of *H. schoeferti* is connected to the vagina by a distinct duct. In contrast, the vagina of *H. californica* forms a swollen blind sac which may also function as a sperm receptacle but lacks a distinct stalk (MacFarland 1923, 1966, this study). The spawn was described to be green in *H. californica* by MacFarland (1966) while spawn was always white transparent in *H. schoeferti* spec. nov.

Concluding, the southeastern Pacific *H. schoeferti*, spec. nov. closely resembles the northeastern Pacific *H. californica* but can be clearly distinguished due to genital differences. Phylogenetic analysis might confirm them as real twin species isolated by the tropics as recently shown for two aeolid nudibranchs of the genus *Flabellina* Voigt, 1834 (Millen & Schrödl, unpublished information).

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References

Behrens, D. W. 1991. Pacific coast nudibranchs. – Sea Challengers, Monterey, California: 107 pp.

Cattaneo-Vietti, R., Chemello, R. & R. Giannuzzi-Savelli. 1990. Atlas of Mediterranean nudibranchs [Atlante dei nudibranchi del Mediterraneo]. – La Conchiglia, Rome. 264 pp., 14 pls.

MacFarland, F. M. 1923. The morphology of the nudibranch genus *Hancockia*. – J. Morph. **38**(1): 65-104
– – 1966. Studies of opisthobranch mollusks of the Pacific coast of North America. – Mem. California Acad. Sci. **6**: 1-546, pls. 1-72
Marcus, E. 1957. On Opisthobranchia from Brazil (2). – J. Linn. Soc. London, Zoology **43**(292): 390-486
McDonald, G. R. 1983. A review of the nudibranchs of the California coast. – Malacologia **24**: 114-276
O'Donoghue, C. H. 1932. Notes on Nudibranchia from Southern India. – Proc. Malacol. Soc. **20**: 141-166
Ortea, J. A. & V. Urgorri. 1979. Primera cita de *Hancockia uncinata* (Hesse, 1872) (Gasteropoda; Nudibranchia) para el litoral ibérico. – Trab. Compostelanos Biol. **8**: 79-86
Schmekel, L. & A. Portmann. 1982. Opisthobranchia des Mittelmeeres. Nudibranchia und Saccoglossa. – Fauna e Flora del Golfo di Napoli, 40. Springer-Verlag, Berlin. 410 pp.
Schrödl, M. 1996. Nudibranchia y Sacoglossa de Chile: Morfología externa y distribución. – Gayana Zoología **60**(1): 17-62
Thompson, T. E. 1972. Eastern Australian Dendronotoidea (Gastropoda: Opisthobranchia). – Zool. J. Linn. Soc. **51**: 63-77